PORTABLE HIGH-RESOLUTION MULTICHANNEL SEISMIC SYSTEM
USER GUIDE

TECHNICAL REPORT

LDEO-96-4

John B. Diebold

April, 1996

LAMONT-DOHERTY EARTH OBSERVATORY OF
COLUMBIA UNIVERSITY

19960501 088

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 03/15/96	3. REPORT TYPE AND DATES COVERED Performance/Final Technical-1/1/95-12/31/95

4. TITLE AND SUBTITLE High Resolution, Multichannel Seismic System for Littoral Zone Subbottom Imaging	5. FUNDING NUMBERS N00014-95-1-0240

6. AUTHOR(S)
Dr. Michael S. Steckler, Dr. John B. Diebold
Dr. Neal W. Driscoll, Dr. Peter Buhl

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The Trustees of Columbia University in the City of New York Box 20 - Low Memorial Library New York, NY 10027	8. PERFORMING ORGANIZATION REPORT NUMBER 5-21749

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Research Ballston Tower One 800 North Quincy St. Arlington, VA 22217-5660	10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Portable High-Resolution Multichannel Seimsic System User Guide--Internal Publication
Lamont-Doherty Earth Observatory Technical Report #96-4 enclosed herewith

12a. DISTRIBUTION/AVAILABILITY STATEMENT This Technical Report LDEO-96-4 is approved for public release - distribution unlimited	12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)
This DURIP award funded the acquisition of the basic components of a new, portable, high resolution MCS system. Equipment will allow ONR and NSF-funded researchers to image sedimentary structures in a variety of geologic settings, but particularly appropriate for shallow water applications. Major items purchased were the 48-channel hydrophone array, four of the seven depth controllers for that array, and the compressor, which supplies air for the source array

14. SUBJECT TERMS NEW, High Resolution PORTABLE MCS seismic system		15. NUMBER OF PAGES
		16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18
298-102

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TECHNICAL REPORT

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LAMONT-DOHERTY EARTH OBSERVATORY OF COLUMBIA UNIVERSITY

L-DEO Portable High Resolution Multichannel Seismic System
User Guide

John B. Diebold

Compressor

Price A-35 AC "Air Gun Master"
S/N# 033095
Weight: 11,000 Lbs
Dimensions: 6' 8" x 8' x 6' 6"

Rated at 178 SCFM
Self-contained cooling system
self-contained starting system
automatic separator blowdown
automatic shutdown system
Integral air receiver & pressure controller
Integral 70 Gal diesel tank
Crankcase and compressor pre-heat for cold weather operation
Detroit Diesel 4-71 1450-1760 rpm

Start: Check fluids. Check clutch disengaged (lever full left, away from diesel) check air blowoff open. Switch fuel shutoff override switch to "Start". Open throttle ca. halfway, press start button. Adjust throttle as necessary. Hold override switch on "start" as necessary while increasing engine speed to 1450 rpm. After a minute or two, engage clutch, readjust engine speed to 1450 rpm. Let compressor run awhile [5 minutes] observe oil pressure on compressor and diesel. Shut blowoff, let pressure build up.

Running: check oil, interstage pressures from time to time. check temperature gauge and feel radiator cap temps with palm. Auto interstage separators blowdowns should "go" about once per 20 minutes. Check for receiver water with small green ball valve every hour or so. Refuel every 8 - 10 hours, depending on roll amplitude.

Stop: Bleed air receiver water. Bleed pressure off gently. Let compressor run unloaded for several minutes. Disengage clutch. Holding fuel shutoff override switch to "start" turn throttle down to ca 500 - 600 rpm, let diesel idle and cool for ca. 5 minutes. Throttle back up and re-engage clutch. Let compressor run unloaded for 2 - 3 minutes. Repeat until Diesel water temperature gauge drops below 150 - 160 degrees C. Shut off diesel by turning throttle down all the way.

Birds

DigiCOURSE 5010 depth keeping birds

S/N#s:
11757
11766
11784
11868

When battery packs are installed, wings should move as bird goes through "wing reset", signaling that self test is complete and OK.

Plug one laptop com port into DigiCOURSE modem module (black chassis in top of gunfire rack) top RS-232 port, plug test coil or plug from OYO into "line 1". On Laptop, disable battery conservation.

cd DigiBIRD, execute digimain.
If a problem, re-copy files from DigiCOURSE floppy.

Change depths, check birds using "diagnostics - bird" from main menu, obtained with shift-Fn-home, then selection "4" twice. Wing reset, if necessary, can be triggered under item 10: "status".

Air Guns

2 @ SSI 210 cu. in. "GI" guns

usable modes:

105 & 105
45 & 105
45 & 45

Highest resolution is "true GI" = 45 & 105, max firing rate 4.5 sec. In "harmonic" mode 45 & 45, max rate 3 sec.

Used gun with 45 spacer in G chamber. Unused gun has no spacers. GSI advises us to replace seals with new ones after use, since spacers retain sea water. This is important!! [Note that later, we were told the drill is to remove seals, then replace old ones just before next use.]

According to manual, it is expected to pressurize gun after submersion.

On *R/V Thompson* cruise TN-057 - had a fair amount of trouble with firing lines; need to stiffen up the last meter before the connectors (by wrapping with friction tape) since the lines are so stretchy that the conductors can pull off terminals inside the connectors with no visible damage to the outside. Should get a short across the solenoids, gun box light flashing when fire.

Gun fire system

In Gray travel rack 27.5" wide 28" deep (covers add 6") x 45" high.

on Laptop:

Plug cable from laptop COM1 to DB25 "Controller" port on gun timer chassis.
disable battery saving options
cd guntime\bin
status17
if hang-up, press F9 - reset RS-232
Generator is gun 01
Injector is gun 02
set delays according to SSI book - ca. 40 ms difference, e.g., 20, 60.

If necessary [they get too big] delete gunDDDYY.dat files

Gun timing system:

seems to work only when all 10 timing modules are turned on.

[On cruise TN-057, worked only when module 3 was turned off. Also, sometimes "data" light
on reset module would stay on bright (unit not working) until module # 3's switch had been
cycled through man - auto - off.]

Apparently, "detect" window is sufficiently small that we only get a detect on one of the two
chambers. This is just as well, as in the absence of a detect on the second chamber, the system
seems to use the (desired) delay specified by the controlling PC.

Connections: "Gun Go" to center pins of the DAS energy source connector. "time break" to the
oscilloscope trigger input. Blast phone terminals to oscilloscope signal input.

I note that "time break" seems to equal "gun Go", timing-wise, not detect, as indicated in the
diagram.

Nicolet scope

This scope is overly complex, but the price was right, and it does do the job.

Trigger section:
Connect trigger input to Field Time Out on back of detect module chassis.
Set "TRIG'D" selector to NORM. settings of "DC/AC" and "+/-" switches seem to have little
effect. Select, say, input module "A". The "TRIG'D" light comes on when a trigger is sensed.

Time per point:
20 microseconds is good.

Storage = "LIVE"

Channel A module:
Input from Blast phone patch in back of gun box. settings -- "ON"; again, "AC/DC" has little or no effect. Set scale for 6 volts.

Display = "Y/T"

Centering = "AUTO" or fool around - seems to do little harm.

Acquisition System

OYO DAS-1 48 channel

17" wide x 20" deep x 12" high

Menu after BIOS test and before C: prompt allows entry into diagnostics. Diagnostics also in startup of Windows 3.1 (TYPE "WIN").

As of 1/96, old version of software in OLDDAS, new in DAS, utilities in DAS2.

CD DAS, type OYODAS, select "Marine Acquisition".

You can't "play" without a tape in the drive!
To set up storage device and/or number of shots (files) per tape, select F4 "Stor". In the "Storage Parameters" frame, select "Storage type". It's little menu has "No Device" at the top and "SCSI" at the bottom. Select "SCSI" and get the "SCSI ID" menu. At the top, highlight entry "SCSI Unit ID 0..." and return. You should see "SCSI LUN ID" menu and at the top of this, "HP DAT"; if you don't, set it up using the Storage utility. At the bottom of the "SCSI UNIT ID" menu, set the number of files. (You have to "esc" out of most of these menus.) Back in the Storage Parameters menu, set the first file and reel numbers. The program normally increments these properly all by itself. Hitting "SAVE" in this utility (Tab over to the "SAVE" box) writes data in memory to the current tape.... I guess this means you can save the remaining portion of a shot to the new tape, if you ran off the end of the previous tape, i.e., normally not to be used.

During cruise TN-057, recorded two-channel with USGS Teledyne streamer. When the DAS was powered up cold, it showed an apparent hardware fault (couldn't talk to data acquisition board COM port) both times we did this with the streamer leads plugged in. Why this should happen, I have no idea. We did get into the DAS with a ribbon cable plugged directly into the first internal jumper socket, but why would this matter? In any case, unplugging before starting OYODAS *the first time* made it work. After that, could restart the program and turn off the power briefly without a problem. - *are there internal batteries?* Another thing that should be done when starting OYODAS is to go through the "Spread" menu, for one thing to undo the "Auto Gain" on the low number traces (Ctl-V to get there) and second since unless you do this, [for some unfathomable reason] the first trace shows up as the only one in channel set 1, and the rest in channel set 2. With no aux channels, the headers are in this (wrong) case 160 bytes - normally would be 128.

When recording is stopped by pressing F8, it starts again automatically after Ctl-A rearms the system.

When tape is full, sends a message asking for a keystroke. upon receipt, unloads tape automatically, starts recording again upon insertion of new tape. To eject a tape, select F6 "Repro", and in its menu, "SCSI Device Utility" and in that menu, "Eject Tape".
Best method is to set the files-per-tape in F4 "storage" to correct number. Then it rewinds and warns you, *appears* to keep track of file numbers properly.

Triggering can be done, apparently, three ways, one internal and two external. trigger type is selected with the F1 "Acquisition" utility. We've been using the "Hammer Switch" setting, which the manual says also works for TTL. Threshold is set for 255, and the "gun go" output of the gun box is connected to pins V [center] and U [just above that] of the "energy source" DAS connector.

Delay is set in the F1 menu, and works, but the delay does not show up where I would expect it in the tape headers; as channel set start time. Luckily, it's in the extended header, (see below) but a good idea to note it manually. Another thing to remember (though not as important) is that in selecting the record length, the system apparently counts the first sample as "zero" time, so that specifying a record length of 4000 msec (at 1 msec digitization rate) will make a record of 4001 samples.

Values used during cruise TN-057 - When there's an arrow ">" there's a sub-menu, which usually must be exited from with "esc" or F8.

Acquisition Parameters

Total Channels	:	24
Number of Auxes	:	0
Sample Rate	:	1.0
Record Length (ms)	:	3500
TB Offset (ms)	:	4000
Stack Parameters	>	1 STACK
Pre-View Stack	:	NO
Correlation Mode	>	Raw Mode
Noise Editing Para	>	No Editing
Filter Parameters	>	Filter [3.000 low cut, 6 dB/octave, No extended cutoff]
Trigger Level (Mv)	:	255
Automatic re-ARM	:	Automatic
Stack Delay (ms)	:	0
Shot Point Delay (ms)	:	0
(TB) Trigger Type	:	Hammer [*equals TTL*]
Arm Request Para	>	Arm Request Para [essentially, "NO"]
Trigger Parameters	>	Trig Para [Auto Trigger : NO]
		[Minimum Cycle (ms) : 9800]
		[Maximum Cycle (ms) : 10000]

F2 - Spread

There's not much of apparent consequence here, since it handles mostly roll-along for land acquisition, *except* for the display that's brought up with Ctl-V, where the channel gains are set - always check these, since there seems to be no way to "unset" the "auto gain" feature which sets the gain of the first channel (when 24 channels are recorded - two when 48) low, assuming land acquisition and loud sources. Going through this process also seems to deter the machine's tendency to record channel one on a different channel set as the rest of the channels - but this is only an empirical observation so far.

F3 - Plot

Controls what you see on the screen, and what goes to hard copy.

F4 - Storage

There are three boxes. Most important is "STORAGE PARAMETERS"

Storage Type   :   SCSI   If there is a tape in the drive, selecting this option
will, when exiting, rewind the tape and prompt the user to continue by Rewinding or Appending.
An easy way to rewind while testing. This item's entry will be reset to "No Device" if there's no
tape in the drive. If this is so, stick a tape in, select "No Device" and hit return. There you get
your choice of things with SCSI at the bottom. Select SCSI and get the next menu, SCSI UNIT
ID. Here you can, among other things, set the max number of files per tape, and change the
SCSI ID of your output (like if you wanted to use an external drive) but normally, it's ID 0 and
LUN 0, where the cursor starts out, showing "No Device". Hit return again, and get the SCSI
LUN# menu. HP-DAT should show up at LUN 0. [*If it doesn't, go to F6 - Repro, SCSI
Utility and set it up under "Select SCSI ID".*]

Back out to the Storage Parameters menu by hitting F8 several times, and you'll be prompted to
rewind/append, and confirm if it's "rewind."

File Number   :   DDDD   This is the next file number to be written. File
                                              numbers can go pretty high -at least to 32K

Reel Number   :   DDDD whatever.
File Format   :   SEGD 8048
Write Confirm   :   NO
Read After Write   :   NO

The bottom menu in the Storage Parameter Menu is called "Observer's Log" - you get there with
the tab key and fill it out if you want. As far as I can tell, the only place this info shows up is in
a header of hard copy coming out of the printer.

To the right, there's a "Save" frame, which apparently saves the Observer's Log info to the hard
drive. Not really a necessary step.

F5 - Utils

                                You know as much as I do about these options.
                                Never required to record data.

F6 - Repro

                                The only important item here has little to do with
                                reproduction, but it makes sense, I guess, if you want to
                                read a shot or two from a data tape. The important item is:

                                SCSI Device Utility

6

The important items here [other than for QC] are:

"Rewind Tape"
"Position to Append"
"Select SCSI ID"
"Eject Tape"

Which are all more or less obvious, except maybe "Select SCSI ID".

Things to watch without real-time display. "TRIGGER" message at bottom of DAS display. Arrivals on "camera" display at top. Gun box lights. "TRG'D" light on scope. Blast phone trace on scope. Light on DAT = pulling tape. Shot number and time on Gun Computer. Shot number changing on DAS display.

DAS-1 Tape format

As of software Rev. 1.25, preferred tape format is SEG-D 8048. This format can be handled by the Lamont in-house tape handling routines, and by JD's software, das_look, segd2segy and segd2sun. Each shot is recorded as a file. The first record in the file is the "general header" whose length can be predicted as:

32 + 32 * (# of channel sets) + 32 * (2 extended header blocks)

There will be either 1 or two channel sets. If aux channels are recorded, they will be recorded as channel set 1, and will have their own 32-byte channel set descriptor, and the streamer data will be channel set two, with another channel set descriptor. If no aux channels are recorded, data will be channel set 1, and the header will be 128 bytes long. [Sometimes, the DAS does something weird, like record streamer channel 1 as channel set 1 and the rest of the channels as channel set 2. Don't know why this happens.] Stuff in these parts of the header correspond to the SEG standard, no problem (with the notable exception that the channel set start and stop times do not include the TB delay, if any). Otherwise, the date, time, digitizing interval, filters, etc., are found here.

There isn't any standard, as far as I know for extended header formats, but the DAS' seems to contain 32 2-byte hex integers. Numbering the values 1 - 32, some of them are:

   1 = file number
   8 = record length (ms)
   9 = unknown - always "2" for me so far
  11 = number of samples in a trace
  13 = Time break delay (msec)
  19 = unknown - always "256" for me so far
  21 = unknown - always "1" for me so far
  25 = unknown - always "3" for me so far
  32 = unknown - variable

The data traces are quite standard. There's a 20-byte header, with no extension. The data are "8048" 32-bit binary format, which is almost identical to IBM floating point, and we handle it the same way (probably correct, within a factor of 16) trace lengths, therefore are 20 + 4 * (number of samples in a trace). If it matters to you, it appears that OYO considers the first sample to have the time of zero (or of the delay) so that at 1 msec sampling, the number of samples is one more than the "Record Length." One weird (?) thing is that the data contain samples with zero value - all 32 bits are zero. I'm not sure if this is "standard" or if the samples really are supposed to be zeros.

ITI 48 channel "stealtharray"

After plugging into OYO, turn on HP power supply @ ca. 27 volts.